

## Why Earthquakes Occur

### Reading and Discussion

Did you know that surface of the Earth is not one giant shell? It may look solid to us, but the Earth's surface has cracks in it, and actually fits together like a puzzle. What happens when one of these gigantic puzzle pieces moves? An earthquake!

Scientists cannot predict *when* an earthquake will take place, but they do understand why Earthquakes happen. They can also tell us which areas of the Earth are most likely to experience an earthquake. Today, you will learn how scientists have put the pieces of the earthquake puzzle together.

### The Earth's Layers and Tectonic Plates

To understand why the Earth occasionally shakes, you must first learn that there are four layers that make up our planet. These are the

1. **inner core**
2. **outer core**
3. **mantle**
4. **crust.**

The crust is the outermost layer of the Earth, and it is made up of a few large pieces that fit together. These pieces are called **tectonic plates**. They are like pieces of a puzzle.

The edges, where tectonic plates meet and move against each other, are called **plate boundaries**. Plate boundaries have many faults, or fault lines, which occur when rock cracks and separates. Changes in the deepest layers of the Earth cause the tectonic plates to move and rub against each other. Sometimes the plates get stuck on a rough spot. They grind against each other, trying but unable to move. When they finally become unstuck, the released energy causes the plates to tremble. The vibration spreads out, and we have an earthquake.

After the main earthquake, there are often smaller quakes called **aftershocks**. These happen because the plates are still settling into place after the big shift. They can continue for *years!*

### Measuring earthquakes

The force of an earthquake can cause major damage to our structures and natural environments. Scientists want to minimize this damage by understanding how earthquakes occur. One way they do this is by measuring earthquakes as they happen. Fault lines are located miles beneath the surface, so scientists are unable to measure how they change. Instead, geologists use a tool called a **seismograph**. Used on the surface of the Earth, a seismograph can measure the seismic energy, or **magnitude**, of an earthquake. It does this by making lines on a page when the Earth vibrates. Lots of wavy lines mean the earthquake was large; fewer waves mean the quake was small.

Name \_\_\_\_\_

Date \_\_\_\_\_

Scientists place seismographs in areas where they expect earthquakes. By studying the marks a seismograph makes, they can tell when and where earthquakes occur, and how big they are.

Magnitudes are recorded on a scale called the **Richter Scale**. The scale begins at 3.5, which is the magnitude assigned to earthquakes we can barely feel, to 8 or greater which are the highest magnitudes. Magnitude 8 earthquakes can destroy cities.

### **Predicting earthquakes**

Scientists have no idea when an earthquake will occur, but they can sometimes predict *where* an earthquake will someday take place. When many faults are located in a single area, the area is called a **fault zone**. Geologists study fault lines and fault zones carefully, because they tell us that the Earth has already shifted in this area. That means another shift is likely.

Seismographs are set up in these areas to record any vibrations from the Earth. Hundreds of earthquakes can happen each year, but they are so small that humans cannot feel them. However, when several small earthquakes happen frequently in the same place, geologists know to prepare for a larger quake. The smaller quakes that happen just before the major earthquake are called **foreshocks**. They warn scientists that the tectonic plates are shifting, and there could be a rough spot ahead.

### **Summing Up**

Earthquakes remind us that our planet is always changing. The ground may feel strong and solid beneath our feet, but the tectonic plates can move without our noticing. Perhaps someday geologists will be able to predict earthquakes the way meteorologists forecast the weather. Until then, they will continue to observe the movement of our planet and engineer stronger, safer structures.

Name \_\_\_\_\_

Date \_\_\_\_\_

## Activities

**Activity A:** Test Your Knowledge! Circle the letter of the correct answer in the questions below.

1. Which of the following is not a layer of the Earth?
  - a. Core
  - b. Mantle
  - c. Crust
  - d. Plates
2. What do scientists call the giant puzzle pieces that make up the Earth's surface?
  - a. Tectonic plates
  - b. Faults
  - c. Boundaries
  - d. Fault lines
3. What is a Seismograph used for?
  - a. to determine where and when earthquakes have occurred
  - b. to predict when an earthquake by sensing foreshocks
  - c. to measure the size of an earthquake
  - d. All of the above
4. What is the Richter scale?
  - a. Tool used to measure the distance between plate boundaries
  - b. System of numbers to describe the size of earthquakes
  - c. Tool to help predict earthquakes
  - d. Chart with the history of earthquakes
5. What is a plate boundary?
  - a. Place where tectonic plates meet
  - b. Edge of an earthquake zone
  - c. Space between fault lines
  - d. None of the above

**Activity B:** If the statement below is true, write a T in the blank. If it is false, write an F.

- \_\_\_ 1. Fault lines are areas where rock has cracked and moved.
- \_\_\_ 2. Aftershocks are very large quakes that happen before a major earthquake.
- \_\_\_ 3. Fault lines most often occur near plate boundaries.
- \_\_\_ 4. Faults exist deep inside the crust of the Earth.

**Name** \_\_\_\_\_

**Date** \_\_\_\_\_

\_\_\_ 5. Foreshocks help geologists predict when and where an earthquake will happen.

**Activity C:** Use the lines below to answer the following questions.

1. How do tectonic plates cause earthquakes?

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2. What does a Seismograph measure? How does it work?

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## Answer Key

### Activity A:

1. D
2. A
3. D
4. B
5. A

### Activity B:

1. T
2. F
3. T
4. T
5. F

### Activity C:

1. The edges, where tectonic plates meet and move against each other, are called **plate boundaries**. Plate boundaries have many faults, or fault lines, which occur when rock cracks and separates. Faults are too deep inside the crust to see. Changes in the deepest layers of the Earth cause the tectonic plates to move and rub against each other. Sometimes the plates get stuck on a rough spot. They grind against each other, trying unsuccessfully to move. When they finally become unstuck, the released energy causes the plates to tremble. The vibration spreads out, and we have an earthquake.

2. Used on the surface of the Earth, a seismograph can measure the seismic energy, or **magnitude**, of an earthquake. It does this by making lines on a page when the Earth vibrates. Lots of wavy lines mean the earthquake was large; fewer waves mean the quake was small. Scientists place seismographs in areas where they expect earthquakes. By studying the marks a seismograph makes, they can tell when and where earthquakes occur, and how big they are.